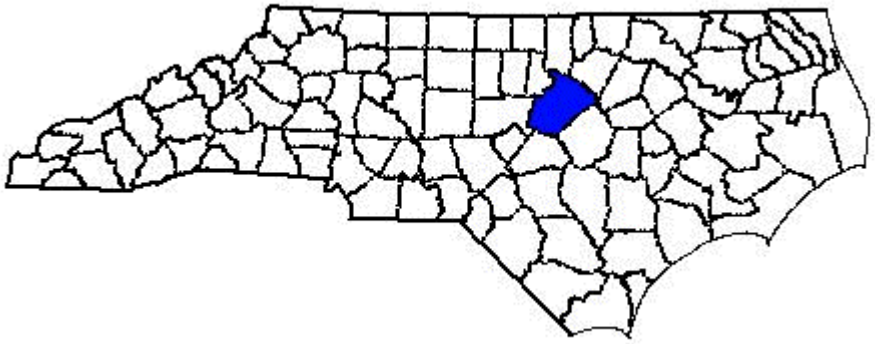
ANNUAL REPORT FOR 2000



New Light Creek Mitigation Site

Wake County

Project No. 8.U401721

TIP No. R-2000 WM

Prepared By:
Natural Systems Unit & Roadside Environmental Unit
North Carolina Department of Transportation
December 2000

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SUMMARY

The following report summarizes the monitoring activities that have occurred in the past year at the New Light Creek Mitigation Site. This site was originally constructed in 1998. Monitoring activities in 2000 represent the second year of monitoring for the site. The site must demonstrate both hydrologic and vegetation success for a minimum of five years.

The site contains six monitoring gauges and four vegetation plots.

This report utilizes rainfall data from both the State Climatic Office at N. C. State University for Raleigh and from on-site rainfall gauges. For the months of March and April, the daily rainfall on the gauge data graphs has been recorded at a Raleigh rain gauge, maintained by the NC State Climate Office. Beginning in May 2000, rainfall has been recorded by two on-site rainfall gauges. These Infinity rainfall gauges are more reliable than previously installed RDS rain gauges at the site.

Four of six monitoring gauges indicate saturation for more than 12.5% of the growing season. Three gauges, GW-2, GW-3, and GW-5, have met the success criteria of consecutive days exceeding at least 12.5% of the growing season. Gauges GW-2 and GW-5, indicate surface water ponding has occurred in their respective areas. Two other gauges, GW-1 and GW-4, indicate wetland hydrology. GW-6 continues to show rapid decreases in the groundwater level following rainfall events. In summary, each gauge showed improvement in comparison to the 1999 hydrological results. Two gauges, GW-2 and GW-5, showed continuous flooding throughout the monitoring period.

Based on the monitoring results from the 2000 growing season, NCDOT recommends that monitoring continue.

1.0 Introduction

1.1 Project Description

The New Light Creek Mitigation Site is located east of Magnum Dairy Road (SR 1911) adjacent to New Light Creek in Wake County near the Granville county line (Figure 1). This site mitigates for wetland impacts associated with the Raleigh Outer Loop (R-2000).

The site, totaling 19.8 acres in size, consists of the creation and restoration of a bottomland hardwood forest. The site was constructed in fall 1998 and planted in winter 1999.

1.2 Purpose

In order to demonstrate successful mitigation, hydrologic and vegetative monitoring must be conducted for a minimum of five consecutive years. Success criteria are based on federal guidelines for wetland mitigation. These guidelines stipulate criteria for both hydrologic conditions and vegetation survival. The following report details the results of hydrologic and vegetative monitoring during 2000 at the New Light Creek Mitigation Site.

Activities in 2000 reflect the second year of monitoring following the restoration efforts. Included in this report are analyses of both hydrologic and vegetative monitoring results as well as local climate conditions throughout the growing season.

1.3 Project History

October 1998	Site grading commenced
February 1999	Site Planted
March 1999	Monitoring Wells Installed
March- November 1999	Hydrologic Monitoring
March- November 1999	Hydrologic Monitoring
September 1999	Vegetation Monitoring (1 yr.)
March- November 2000	Hydrologic Monitoring
November 2000	Vegetation Monitoring (2 yr.)

Figure 1. Site Location Map

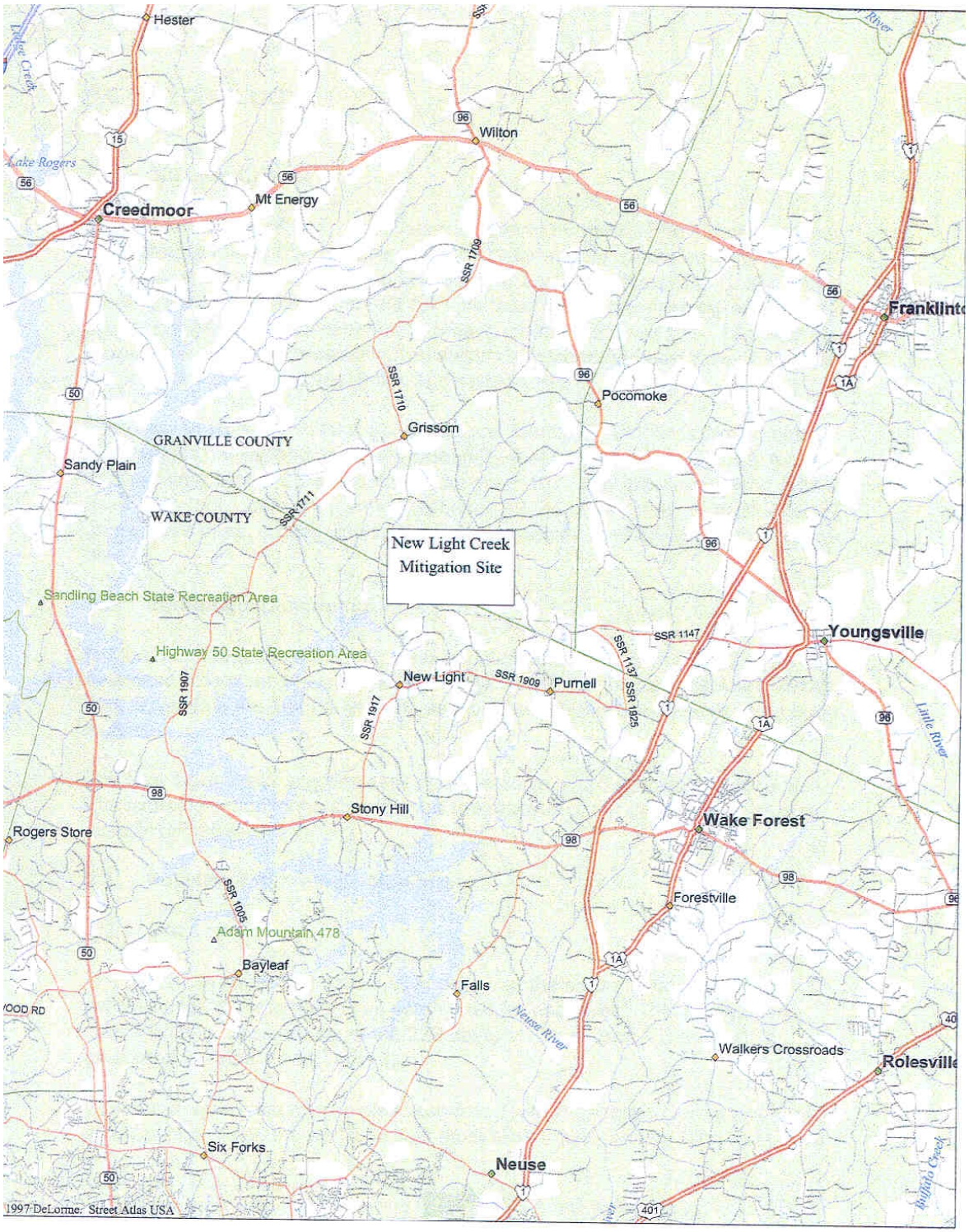


FIGURE 1
SITE LOCATION MAP

2.0 HYDROLOGY

2.1 Success Criteria

In accordance with federal guidelines for wetland mitigation, the success criteria for hydrology states that the area must be inundated or saturated (within 12" of the surface) by surface or groundwater for at least a consecutive 12.5% of the growing season. Area inundated for less than 5% of the growing season are always classified as non-wetlands. Areas inundated between 5% - 12.5% of the growing season can be classified as wetlands depending upon factors such as the presence of wetland vegetation and hydric soils.

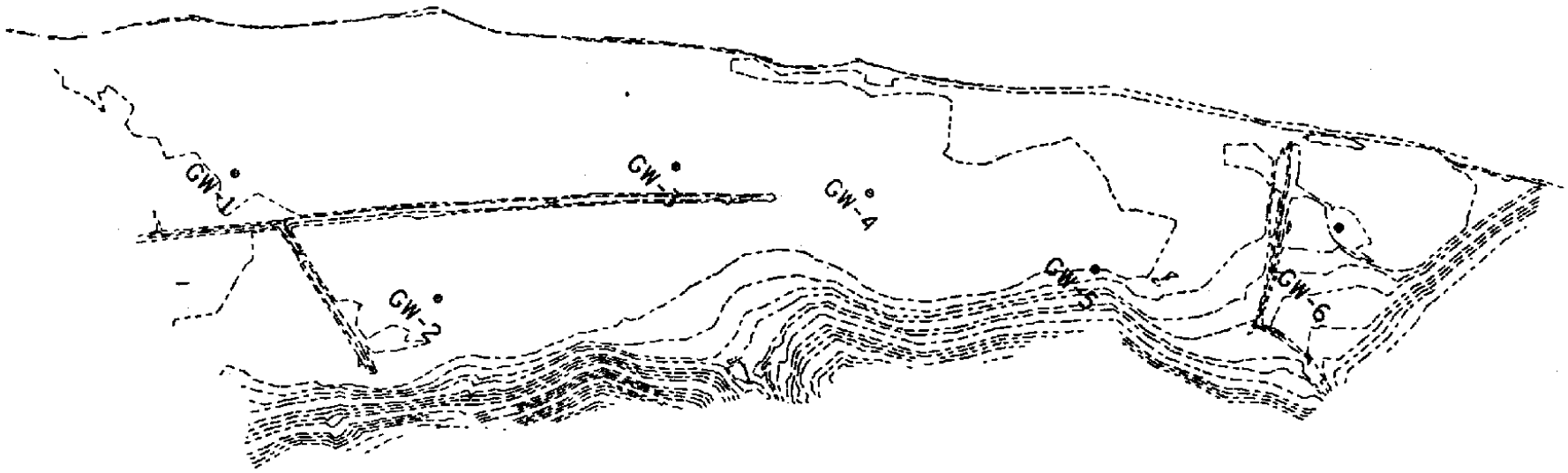
The growing season in Wake County begins March 26 and ends November 10. These dates correspond to a 50% probability that temperatures will drop to 28°F or lower after March 26 and before November 10.[1] The growing season is 229 days; therefore, optimum hydrology requires 12.5% of this season, or at least 29 consecutive days. Local climate must also represent average conditions for the area.

2.2 Hydrologic Description

In March of 1999, six monitoring wells were installed across the site (Figure 2). The automatic monitoring gauges record daily readings of groundwater depth. This represents the second full growing season that the monitoring wells have been in place.

[1] Natural Resources Conservation Service, Soil Survey of Wake County, North Carolina.

Figure 2. New Light Creek Monitoring Gauge Location Map.



The New Light Creek site was designed to receive hydrologic input from rainfall. The hydrologic monitoring should show the reaction of the groundwater level to specific rainfall events.

2.3 Results of Hydrologic Monitoring

2.3.1 Site Data

The maximum number of consecutive days that the groundwater was within twelve inches of the surface was determined for each well. This number was converted into a percentage of the 229-day growing season. The results are presented in Table 1.

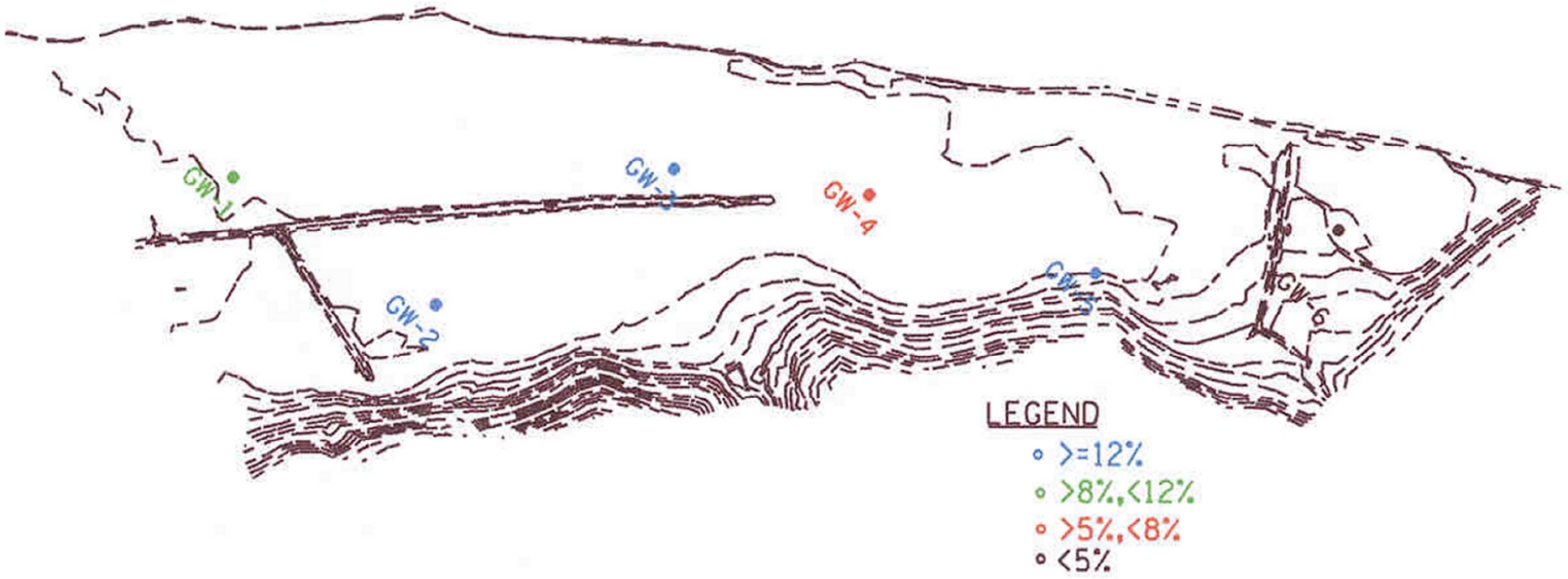
Appendix A contains a plot of the groundwater depth for each monitoring well and the surface water depth recorded by the surface gauge. The maximum number of consecutive days is noted on each graph. The individual precipitation events, shown on the monitoring well graphs as bars, represent data collected from a Raleigh weather station for the months of March and April, and the average rainfall of two on-site rain gauges for months May through November. This data was provided by the NC State Climate Office.

Table 1. New Light Creek Hydrologic Monitoring Results.

Monitoring Well	< 5%	5% - 8%	8% - 12.5%	> 12.5%	Actual %	Success Dates
GW-1			✔		10.9	Jul. 23 – Aug. 16
GW-2				✔	100	Mar. 26 – Nov. 10
GW-3				✔	18.3	Mar. 26 – May 6
GW-4		✔			7.0	Jul. 24 – Aug. 8
GW-5				✔	100	Mar. 26 – Nov. 10
GW-6	✔				3.0	Jul. 24 – Jul. 30

Figure 3 represents a graphical representation of the hydrologic results. Wells highlighted in blue indicate wetland hydrology for more than 12.5% of the growing season. Wells highlighted in green show hydrology between 8% and 12.5% of the season, while those in red indicate hydrology between 5% and 8% of the season. Gauges highlighted in black indicate no wetland hydrology (less than 5% of the growing season).

Figure 3. New Light Creek Monitoring Gauge Hydrologic Results.



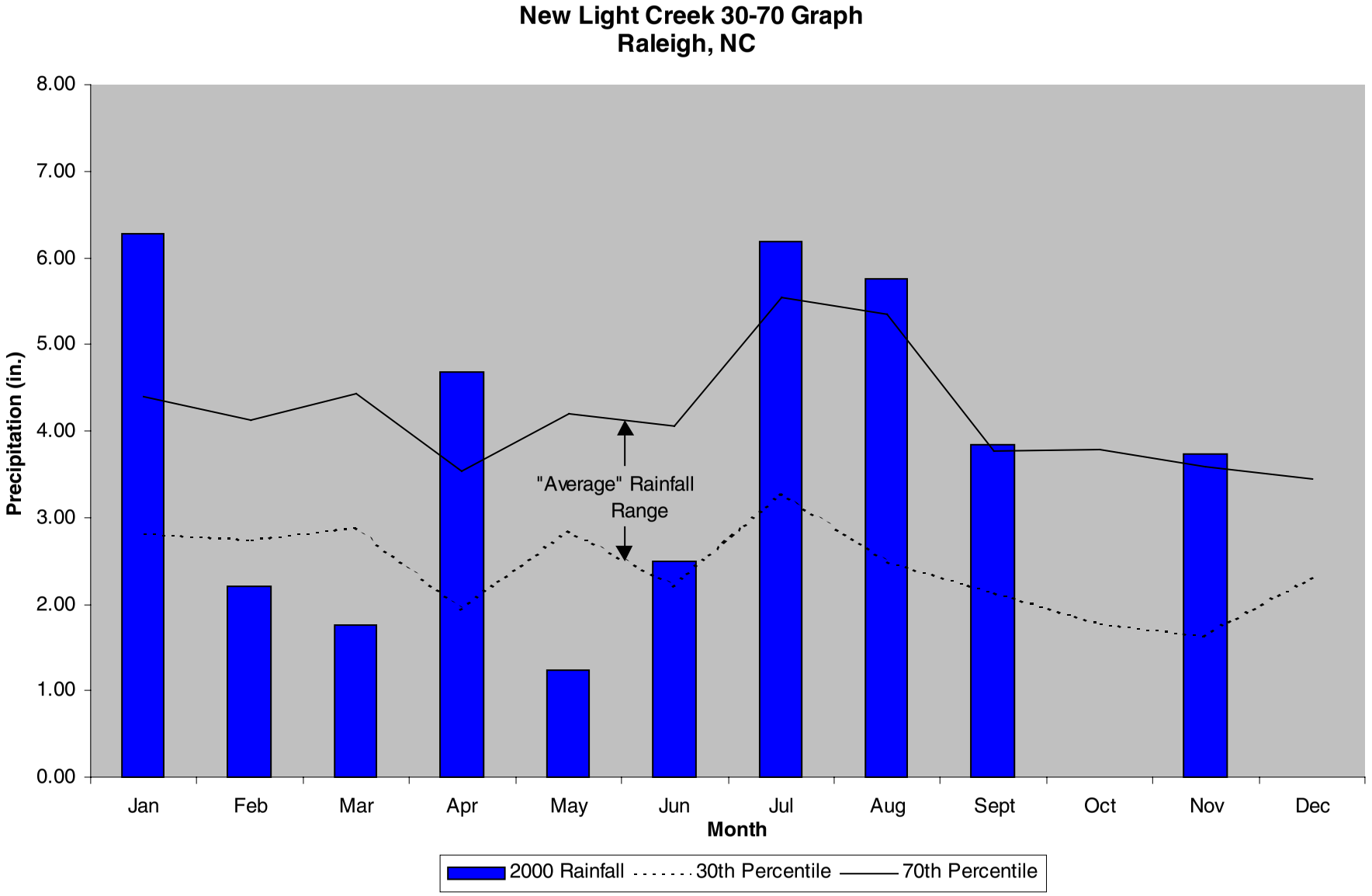
2.3.2 Climatic Data

Figure 4 represents an examination of the local climate in comparison with historical data in order to determine whether 2000 was "average" in terms of climate conditions. The two lines represent the 30th and 70th percentiles of monthly precipitation for Raleigh. The bars are the monthly rainfall totals for 2000. The historical data was collected by the National Climatic Data Center, while the State Climate Office of North Carolina provided the recent rainfall data. Please note the dry conditions that occurred from May through July.

2.4 Conclusions

2000 represents the second full growing season that the hydrologic data has been examined. Three gauges, GW-2, GW-3, and GW-5, have met the success criteria of consecutive days exceeding at least 12.5% of the growing season. Gauges GW-2 and GW-5, indicate ponding has occurred in their respective areas. Two other gauges, GW-1 and GW-4, indicate wetland hydrology. GW-6 continues to show rapid decreases in the groundwater level following rainfall events. In summary, each gauge showed improvement in comparison to the 1999 hydrological results.

Figure 4.


New Light Creek 30-70 Graph
Raleigh, NC
Precipitation (in.)
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
"Average" Rainfall Range
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
Oct
Nov
Dec
Month
2000 Rainfall
30th Percentile
70th Percentile

3.0 VEGETATION: NEW LIGHT CREEK.

3.1 Success Criteria

NCDOT will monitor the site for five years. A 320 stems per acre survival criterion for planted seedlings will be used to determine success for the first three years. The required survival criterion will decrease by 10% per year after the third year of vegetation monitoring (i.e., for an expected 290 stems per acre for year 4, and 260 stems per acre for year 5). The number of plants of one specie will not exceed 20% of the total number of plants of all species planted.

3.2 Description of Species

The following species were planted in the Wetland Enhancement/Preservation Area:

Bottomland Hardwood Area (12.2 Ac.)

Quercus phellos - willow oak
Quercus pagodaefolia - cherrybark oak
Fraxinus pennsylvanica - green ash
Nyssa sylvatica - blackgum
Quercus lyrata - overcup oak
Quercus michauxii - swamp chestnut oak

Levee Area (1.0 Ac.)

Betula nigra - river birch
Quercus *lyrata* - overcup oak
Quercus phellos - willow oak
Platanus occidentalis - sycamore
Juglans nigra - black walnut

3.3 Results of Vegetation Monitoring

Plot # (Type)	Black Gum	Cherrybark Oak	Green Ash	Overcup Oak	Swp Chestnut Oak	Willow Oak	Black Walnut	Total	Total (at planting)	Density (Tree/Acre)
1 (B L H /L e v e e)	1	2		5	1 0	4	5	2 7	3 7	4 9 6
2 (B L H)		8	0	1 1	4	4		2 7	3 8	4 8 3
3 (B L H)	2	1 0	1 1	2			1	2 6	3 4	5 2 0
4 (B L H)	2	2	6	3	1 4	2		2 9	3 7	5 3 3
					A V E R A G E D E N S I T Y					**5 0 8**

To determine tree density, 50' x 50' plots were installed immediately following planting. The actual numbers of planted trees that occur within the plot have been counted. This number was equated to the number within each plot, which represents 680 trees per acre (average). The survival monitoring number is compared to the planted number to obtain survival percentage. This percentage is applied to the 680 trees per acre to obtain an estimated tree per acre for the site. (Density = monitoring count / planted trees x 680).

Site Notes: Volunteer Green Ash and Sycamore found throughout site. There is a band through the middle of the site with a slightly lower elevation containing various wetland species including: Juncus, Scirpus, cyperus, black willow, cattail. Standing water present throughout middle band. Heavy grasses exist throughout the site including: Fescue, Smartweed, Japanese grass, Jewel weed, Carex, Leersia sp. (Cutgrass), Perilla Frutoscens (Beef stake plant), aster and fennel. Trees were difficult to find in plot 1 and 3 due to heavy grasses.

3.4 Conclusions

Of the 19.8 total acres on this site, approximately 13.2 acres involved tree planting. There were four vegetation-monitoring plots established throughout the site. The vegetation monitoring of the site resulted in an average tree density of 508 trees per acre, well above the minimum required by the success criteria.

Washout along the stream bank caused by Hurricane Floyd was reviewed by NCDOT, and the USACE was notified of this problem in June 2000. It was agreed that NCDOT would repair the washout. This work has not yet been done. A site inspection in September revealed this washout might be stabilizing on its own. NCDOT will continue to monitor this area to determine if this slope will remain stable.

4.0 OVERALL CONCLUSIONS/ RECOMMENDATIONS

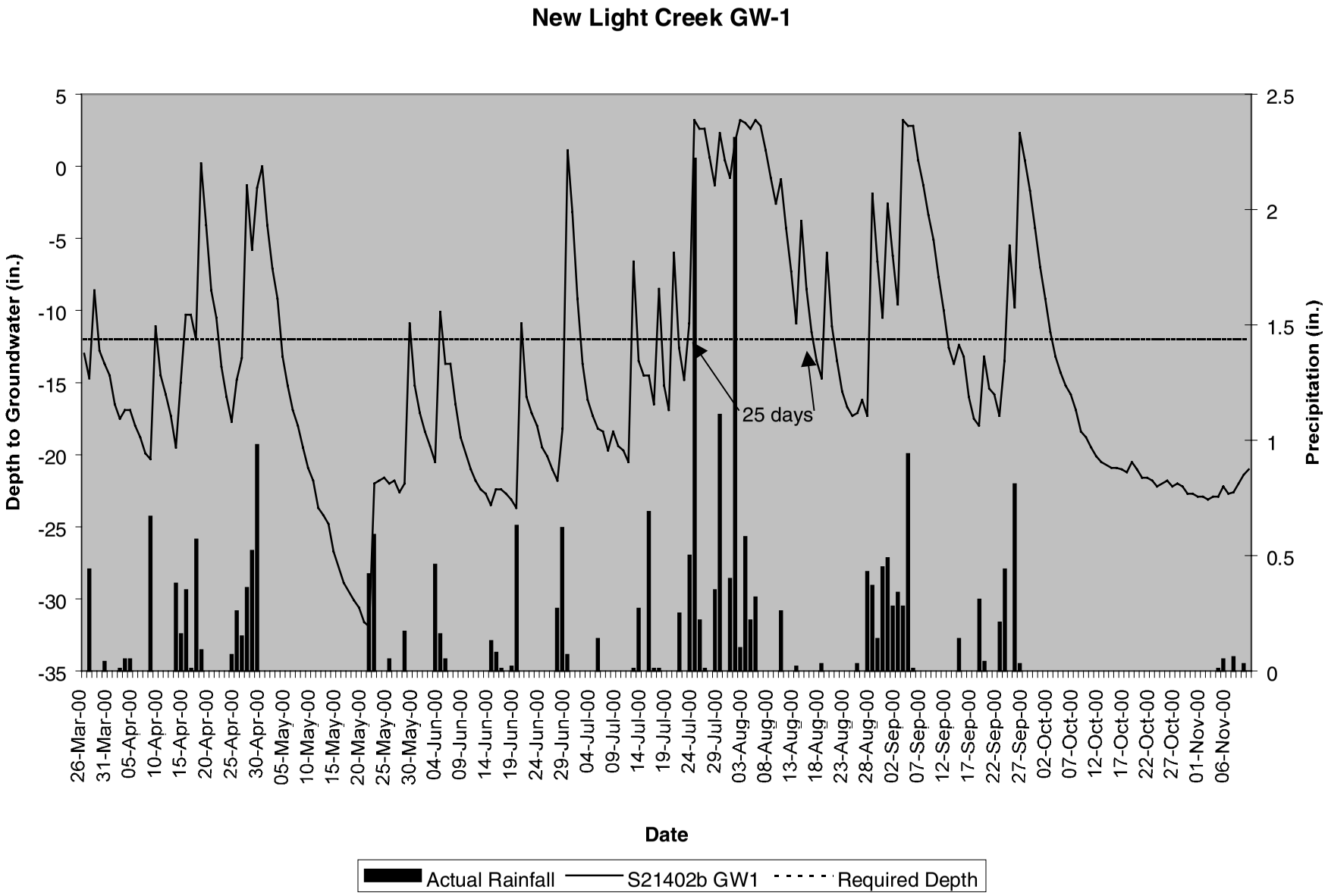
The New Light Creek Mitigation Site has improved hydrologic results. It is recommended that hydrologic monitoring continue in order to determine whether the site will continue to improve over time.

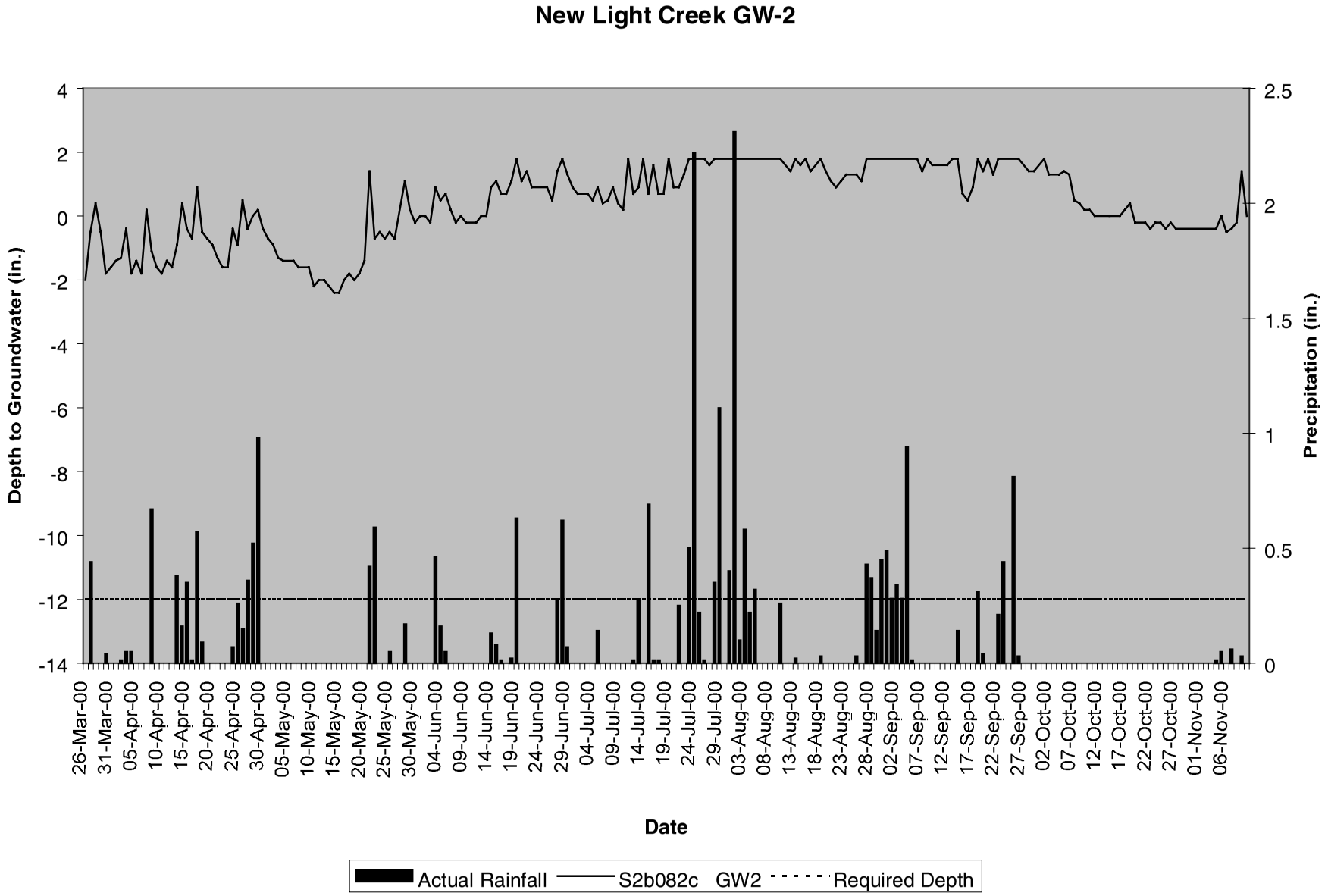
All of the vegetation monitoring plots have indicated an average tree density of over 320 trees per acre. It is anticipated that vegetation success will continue.

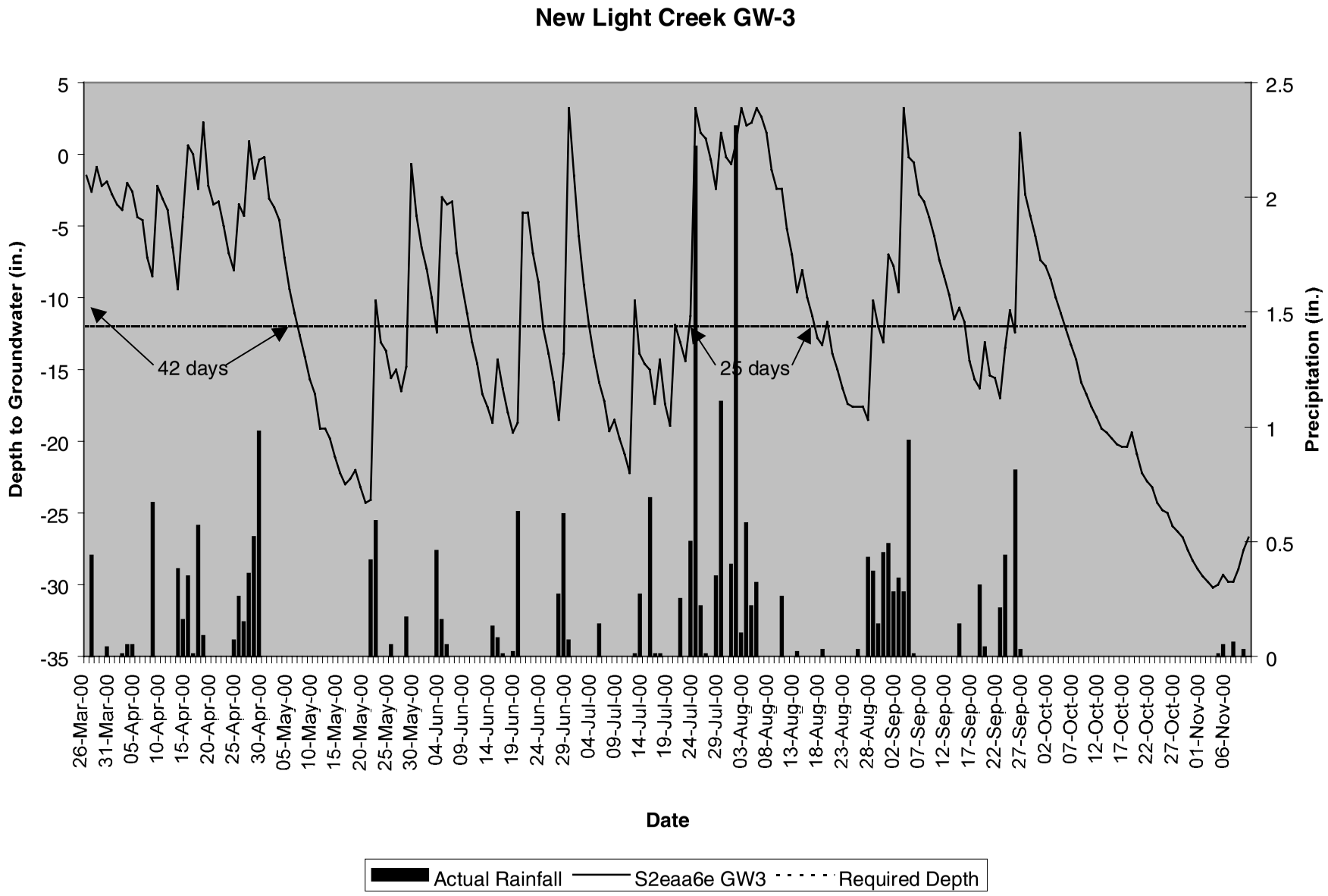
NCDOT will continue to monitor the washout area along the stream bank, caused by Hurricane Floyd in September 1999, to determine if this slope will remain stable.

APPENDIX A

DEPTH TO GROUNDWATER GRAPHS


New Light Creek GW-1
Depth to Groundwater (in.)
Precipitation (in.)
5
0
-5
-10
-15
-20
-25
-30
-35
2.5
2
1.5
1
0.5
0
25 days
26-Mar-00
31-Mar-00
05-Apr-00
10-Apr-00
15-Apr-00
20-Apr-00
25-Apr-00
30-Apr-00
05-May-00
10-May-00
15-May-00
20-May-00
25-May-00
30-May-00
04-Jun-00
09-Jun-00
14-Jun-00
19-Jun-00
24-Jun-00
29-Jun-00
04-Jul-00
09-Jul-00
14-Jul-00
19-Jul-00
24-Jul-00
29-Jul-00
03-Aug-00
08-Aug-00
13-Aug-00
18-Aug-00
23-Aug-00
28-Aug-00
02-Sep-00
07-Sep-00
12-Sep-00
17-Sep-00
22-Sep-00
27-Sep-00
02-Oct-00
07-Oct-00
12-Oct-00
17-Oct-00
22-Oct-00
27-Oct-00
01-Nov-00
06-Nov-00
Date
Actual Rainfall
S21402b GW1
Required Depth


New Light Creek GW-2
Depth to Groundwater (in.)
Precipitation (in.)
4
2
0
-2
-4
-6
-8
-10
-12
-14
2.5
2
1.5
1
0.5
0
26-Mar-00
31-Mar-00
05-Apr-00
10-Apr-00
15-Apr-00
20-Apr-00
25-Apr-00
30-Apr-00
05-May-00
10-May-00
15-May-00
20-May-00
25-May-00
30-May-00
04-Jun-00
09-Jun-00
14-Jun-00
19-Jun-00
24-Jun-00
29-Jun-00
04-Jul-00
09-Jul-00
14-Jul-00
19-Jul-00
24-Jul-00
29-Jul-00
03-Aug-00
08-Aug-00
13-Aug-00
18-Aug-00
23-Aug-00
28-Aug-00
02-Sep-00
07-Sep-00
12-Sep-00
17-Sep-00
22-Sep-00
27-Sep-00
02-Oct-00
07-Oct-00
12-Oct-00
17-Oct-00
22-Oct-00
27-Oct-00
01-Nov-00
06-Nov-00
Date
Actual Rainfall
S2b082c GW2
Required Depth


New Light Creek GW-3
Depth to Groundwater (in.)
Precipitation (in.)
5
0
-5
-10
-15
-20
-25
-30
-35
2.5
2
1.5
1
0.5
0
42 days
25 days
26-Mar-00
31-Mar-00
05-Apr-00
10-Apr-00
15-Apr-00
20-Apr-00
25-Apr-00
30-Apr-00
05-May-00
10-May-00
15-May-00
20-May-00
25-May-00
30-May-00
04-Jun-00
09-Jun-00
14-Jun-00
19-Jun-00
24-Jun-00
29-Jun-00
04-Jul-00
09-Jul-00
14-Jul-00
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13-Aug-00
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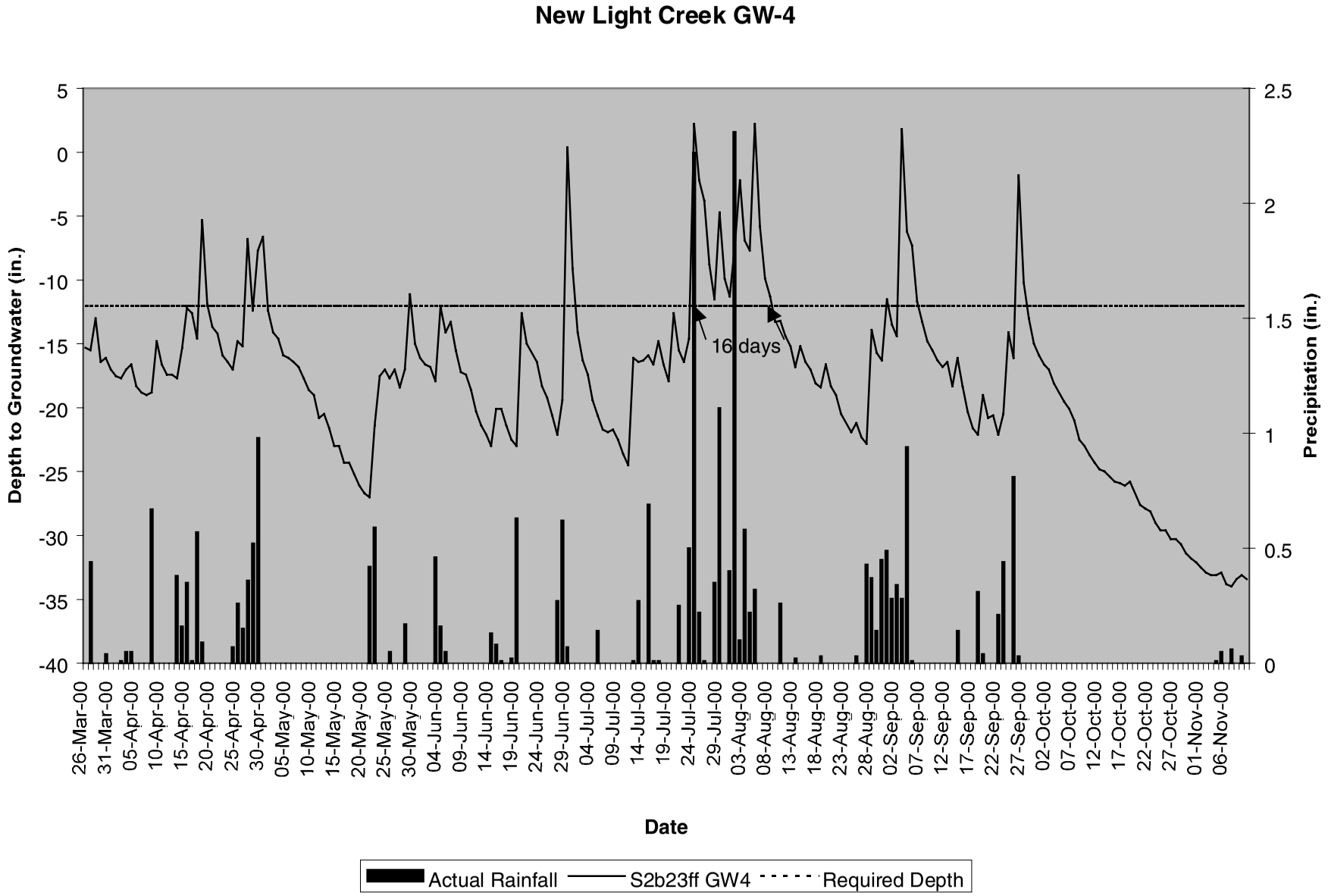
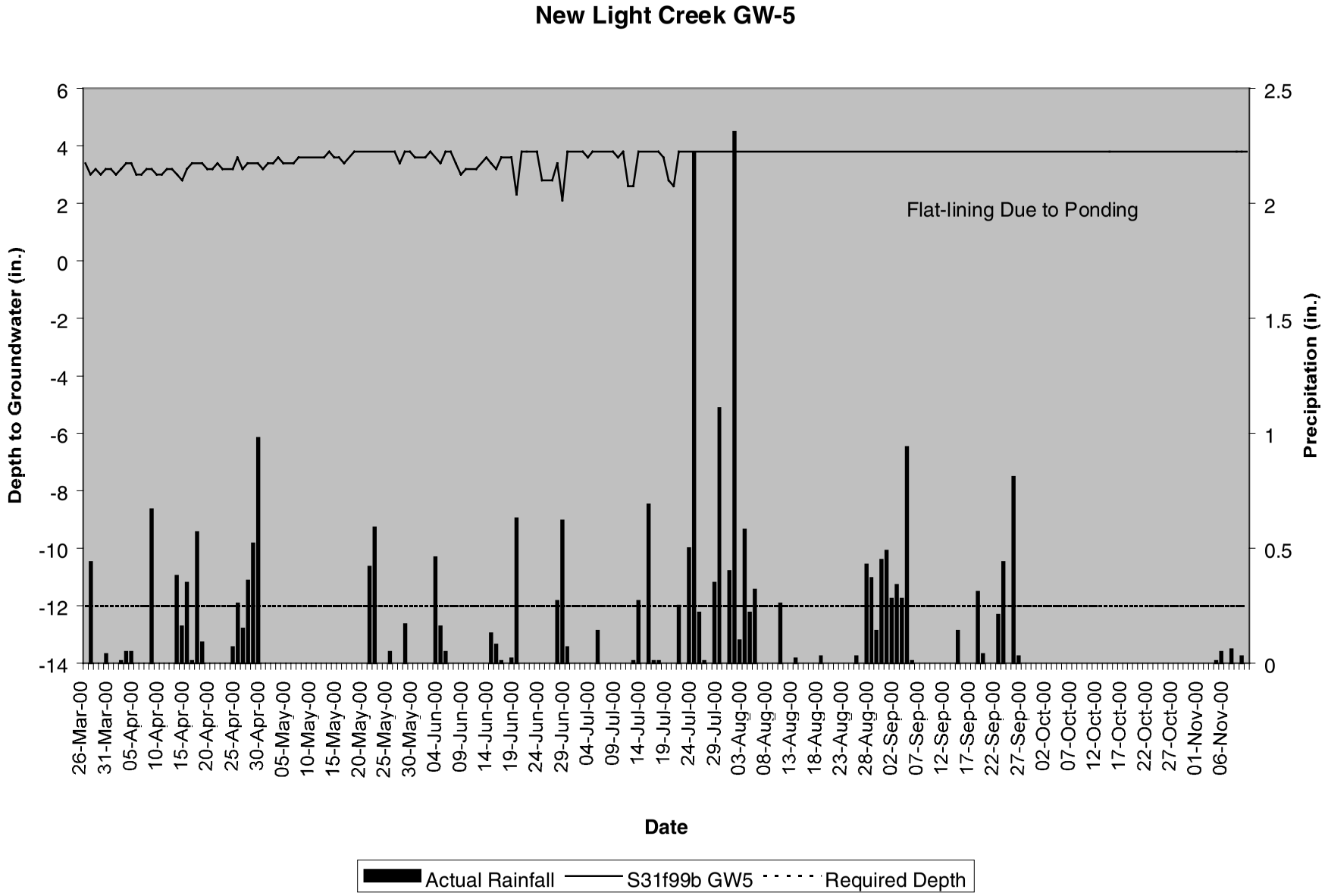
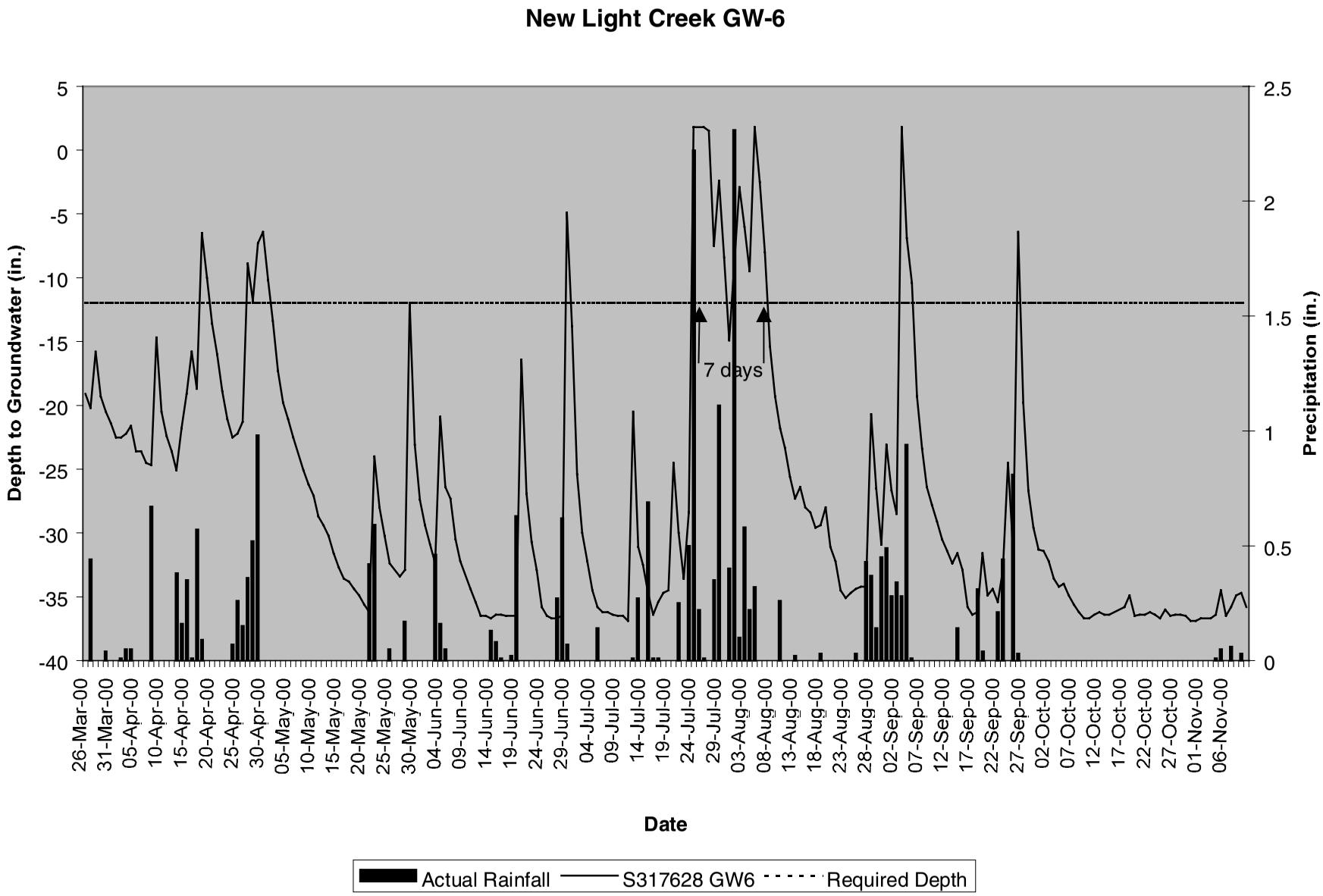
23-Aug-00
28-Aug-00
02-Sep-00
07-Sep-00
12-Sep-00
17-Sep-00
22-Sep-00
27-Sep-00
02-Oct-00
07-Oct-00
12-Oct-00
17-Oct-00
22-Oct-00
27-Oct-00
01-Nov-00
06-Nov-00
Date
Actual Rainfall
S2eaa6e GW3
Required Depth


New Light Creek GW-4
Depth to Groundwater (in.)
Precipitation (in.)
16 days
Date
Actual Rainfall
S2b23ff GW4
Required Depth


New Light Creek GW-5
Depth to Groundwater (in.)
Precipitation (in.)
Flat-lining Due to Ponding
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
2.5
2
1.5
1
0.5
0
26-Mar-00
31-Mar-00
05-Apr-00
10-Apr-00
15-Apr-00
20-Apr-00
25-Apr-00
30-Apr-00
05-May-00
10-May-00
15-May-00
20-May-00
25-May-00
30-May-00
04-Jun-00
09-Jun-00
14-Jun-00
19-Jun-00
24-Jun-00
29-Jun-00
04-Jul-00
09-Jul-00
14-Jul-00
19-Jul-00
24-Jul-00
29-Jul-00
03-Aug-00
08-Aug-00
13-Aug-00
18-Aug-00
23-Aug-00
28-Aug-00
02-Sep-00
07-Sep-00
12-Sep-00
17-Sep-00
22-Sep-00
27-Sep-00
02-Oct-00
07-Oct-00
12-Oct-00
17-Oct-00
22-Oct-00
27-Oct-00
01-Nov-00
06-Nov-00
Date
Actual Rainfall
S31f99b GW5
Required Depth


New Light Creek GW-6
Depth to Groundwater (in.)
Precipitation (in.)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
2.5
2
1.5
1
0.5
0
7 days
26-Mar-00
31-Mar-00
05-Apr-00
10-Apr-00
15-Apr-00
20-Apr-00
25-Apr-00
30-Apr-00
05-May-00
10-May-00
15-May-00
20-May-00
25-May-00
30-May-00
04-Jun-00
09-Jun-00
14-Jun-00
19-Jun-00
24-Jun-00
29-Jun-00
04-Jul-00
09-Jul-00
14-Jul-00
19-Jul-00
24-Jul-00
29-Jul-00
03-Aug-00
08-Aug-00
13-Aug-00
18-Aug-00
23-Aug-00
28-Aug-00
02-Sep-00
07-Sep-00
12-Sep-00
17-Sep-00
22-Sep-00
27-Sep-00
02-Oct-00
07-Oct-00
12-Oct-00
17-Oct-00
22-Oct-00
27-Oct-00
01-Nov-00
06-Nov-00
Date
Actual Rainfall
S317628 GW6
Required Depth

APPENDIX B

SITE PHOTOS

NEW LIGHT CREEK

Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

Photo 6

2000

NEW LIGHT CREEK

Photo 7

NEW LIGHT CREEK MITIGATION SITE
VEGETATIVE PLOT AND PHOTO POINT LOCATIONS
2000 MONITORING